GASTROINTESTINAL ANGIOGRAPHY

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track through the soft tissues into the artery. When it is removed, the catheter generally passes freely along the path made by the dilator catheter. As the catheter is advanced into the aorta, the guide wire should be held stationary.

In extremely obese patients, the catheter tends to buckle in the soft tissues, particularly when the distal tip of the catheter and the distal curve have already passed through the skin. This can usually be avoided by making the puncture in the depths of the inguinal crease. It is especially important to angle the needle puncture to 45 degrees in obese patients. A more vertical puncture will lead to a vertical position of the catheter in the soft tissues and to great difficulty manipulating the catheter once it is in place (Fig. 1–11). It is imperative that the catheter move forward when advanced instead of buckling in the soft tissues.

Catheterization of Aortic Visceral Branches

The celiac artery arises from the aorta anteriorly at the level of the lower half of the T12 vertebral body or the T12–L1 interspace; the superior mesenteric artery, anteriorly at the T12–L1 interspace or the upper portion of the L1 vertebral body; and the inferior mesenteric artery approximately at the lower L3 vertebral body anteriorly and slightly to the left of the midline. The area on which the image intensifier is to be centered for the catheterization can be easily localized by identifying the last rib (and thereby T12) and then counting down the appropriate number of vertebral bodies. Another localization method requires renal artery catheterization first and then appropriate adjustment of the catheter. The superior mesenteric artery lies anterior and just cephalad to the right renal artery and the celiac artery lies 0.5 to 2.0 cm further cephalad.

When the intensifier is centered over the artery to be catheterized, the catheter is rotated so that its tip is anterior. If the catheter is rotated in a clockwise direction at the groin, it will appear to the patient's right if the tip is posterior and to the left if the tip is anterior. Conversely, a counterclockwise rotation will make the tip move toward the patient's right if the tip is anterior and to the left, if posterior. This relationship is sometimes difficult for the beginning angiographer to grasp.

The celiac or superior mesenteric arteries may be catheterized either with the tip extended upward or with the catheter

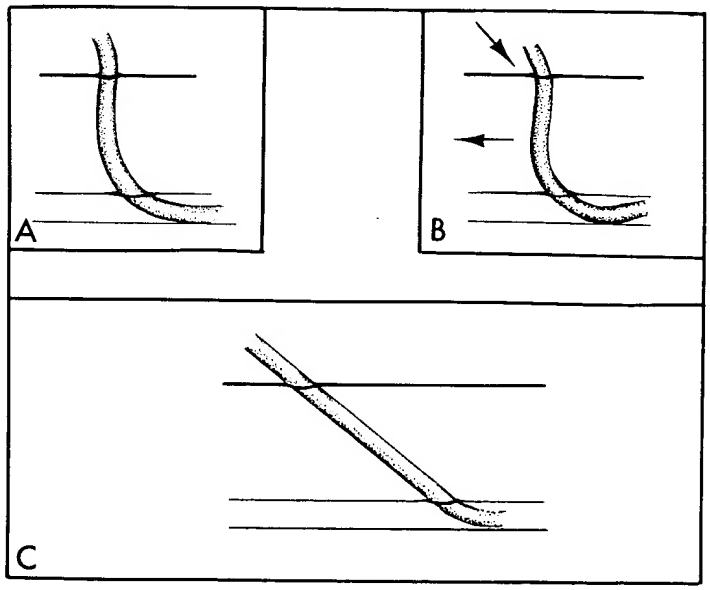

Figure 1–11. Buckling of catheter in the soft tissues of the groin in obese patients.

A. There is a tendency for beginning angiographers to make too vertical a puncture of the femoral artery in obese patients.

B. When an attempt is made to advance the catheter, it may buckle in the soft tissue; therefore, the tip of the catheter becomes very difficult to control.

C. This buckling can be corrected by maintaining the correct 45 degree angle for the puncture so that forward force is transmitted in a straighter line. This helps to avoid such buckling.

turned so that the tip points downward (Fig. 1–12). In most people the celiac artery has a downward direction and the turned position is best, but in obese patients, the celiac artery generally has an upward direction at its origin and is more easily catheterized with an upward pointing catheter tip. The superior mesenteric artery can generally be catheterized with either technique.

When the guide wire is removed from a catheter in the aorta, the tip usually points upward. The tip can generally be turned downward simply by advancing the catheter without the guide wire in place. The tip usually enters a renal, lumbar, celiac or mesenteric artery. Further advancing then turns the tip. On occasion it is difficult to get the catheter tip turned downward, usually because the distal limb is too long for the diameter of the patient's aorta. If this difficulty occurs, one should catheterize a renal artery at the L1–2 interspace, and then continue to advance the catheter up the aorta. The tip will back out of the renal artery in the turned position (Fig. 1–13). If this is not possible, the catheter can be advanced to the aortic arch, where it generally turns into its natural, preshaped configuration. The catheter can then be drawn into the abdominal aorta with the tip in the turned position. To prevent the tip from catching in orifices on the way down, the catheter should be rotated as it is drawn back. Whenever the catheter tip enters an arterial orifice or catches on an atherosclerotic plaque, rotation will cease. The catheter must then be advanced slightly and the rotation and withdrawal procedure continued.

On the other hand, if the catheter is in the turned position and it is desirable to have the tip extended, this can generally be accomplished by simply drawing the catheter down. The tip then catches in an arterial orifice and continued withdrawal extends the tip (Fig. 1–13). On rare occasions the guide wire must be reintroduced while withdrawing the catheter in order to extend the tip.

If the radius of the distal bend of the catheter or the length of the tip is too great, the tip may point back toward the center of the aorta in the turned position and the visceral vessels become impos-

Figure 1–12. Catheterization with the tip in the extended and turned positions. An artery may be entered by advancing the catheter with the tip extended or the catheter may be withdrawn into the artery with the tip in the turned position.

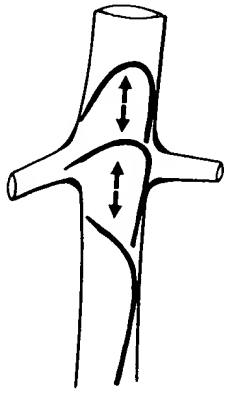

Figure 1–13. Turning the catheter tip in a renal artery. The catheter tip can be either turned or extended by catheterizing a renal artery. This can be done in arteries other than the renal arteries, but the renal is easiest because of its relatively constant location at the L1-2 interspace and its lateral position in the aorta. When the desired direction of the catheter tip is achieved, the tip is rotated anteriorly and advanced or withdrawn into the celiac or superior mesenteric arteries.

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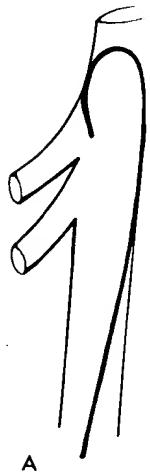

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sible to enter. Two maneuvers may be used to correct this prior to catheter exchange. First, catheterization can be tried with the tip pointing up. This is generally unsatisfactory since there is not enough anterior angulation at the tip. Second, if the catheter is in the turned position, the tip can be directed against the wall by inserting a guide wire to change the angle of the bend (Fig. 1–14). This often is successful if no atherosclerosis is present. If a fair degree of atherosclerosis is present, the catheter must be exchanged for one with a more suitable tip. Conversely, in patients with ectatic aortas the catheter must have a greater radius of curvature and a longer distal limb. In the latter patient this is also important to prevent recoil during the injection. The appropriately shaped catheter is so necessary to the completion of an examination that one must always be willing to exchange catheters.

The inferior mesenteric artery is slightly more difficult to catheterize than either the celiac or superior mesenteric arteries because the lower aorta is narrower and more often has significant atherosclerotic changes. Also, the orifice of the inferior mesenteric artery is much smaller than that of the celiac or superior mesenteric arteries. With a correctly shaped catheter, however, inferior mesenteric artery catheterization generally can be accomplished.

When the catheter has been placed in the desired vessel, it should be seated as far as possible into the vessel and any redundancy along the catheter should be removed. Both of these maneuvers help prevent catheter recoil and subintimal dissection during the injection of contrast medium. A forceful hand injection of saline should be made with fluoroscopic monitoring to see if the catheter position is stable.

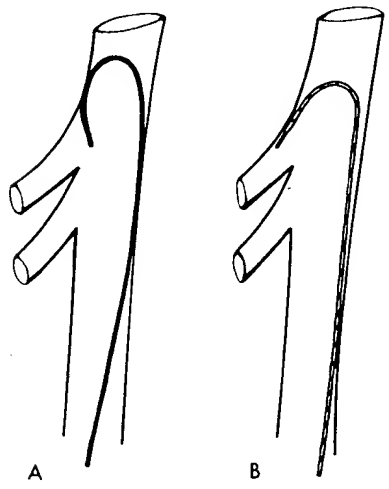

Figure 1–14. Distal limb of the catheter too long for the diameter of the aorta.

A. When the catheter tip is too long for the patient's aorta, the tip is directed back toward the lumen and introduction of the catheter into the celiac or superior mesenteric arteries becomes impossible. Even turning the catheter in the renal arteries as demonstrated in Figure 1–13 is impossible. Frequently the catheter will have to be exchanged for one with a more suitable distal limb.

B. Prior to exchanging the catheter, however, a guide wire can be introduced to the tip in an attempt to slightly extend the tip of the catheter and direct it toward the wall of the aorta.

Catheterization in the Presence of Atherosclerosis

If the patient does not have atherosclerotic irregularity of the aorta, the catheterization of the abdominal visceral branches is quite easy and takes only several seconds of fluoroscopy time. When atherosclerosis is present, however, a steady, smooth manipulation of the catheter tip may be difficult. The most common problem that the beginning angiographer has with atherosclerosis is that the catheter tip turns against a plaque and stops even though rotation is continued at the puncture site. Suddenly it releases and flips around the aorta. This can be avoided in two ways. First, short, sawing motions should be used as one slowly rotates the catheter. This helps to avoid catching the tip on plaques. If the catheter tip still catches and stops, it should be rotated in the other direction. Frequently, the catheter tip will then be easier to control. Also, if torque is built up during rotation, the catheter should be